Confirmation No. 6402

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	LANKHORST *et al.*	Examiner:	Lee, Eugene
Serial No.:	10/599,270	Group Art Unit:	2815
Filed:	September 25, 2006	Docket No.:	NL040358US1 (NXPS.682PA)
Title:	ELECTRIC DEVICE COMPRISING PHASE CHANGE MATERIAL		

APPEAL BRIEF

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Dear Sir:

This Appeal Brief is submitted pursuant to 37 C.F.R. §41.37, in support of the Notice of Appeal filed November 16, 2010 and in response to the rejections of claims 1-21 as set forth in the Final Office Action dated August 16, 2010.

Please charge Deposit Account number 50-4019 (NL040358US1) $540.00 for filing this brief in support of an appeal as set forth in 37 C.F.R. §1.17(c). If necessary, authority is given to charge/credit Deposit Account 50-4019 additional fees/overages in support of this filing.

I. Real Party In Interest

The real party in interest is NXP Semiconductors. The application is presently assigned of record, at reel/frame nos. 021372/0965 to NXP, B.V., headquartered in Eindhoven, the Netherlands.

I. Related Appeals and Interferences

While Appellant is aware of other pending applications owned by the above-identified Assignee, Appellant is unaware of any related appeals, interferences or judicial proceedings that would have a bearing on the Board's decision in the instant appeal.

III. Status of Claims

Claims 1-21 stand rejected and are presented for appeal. A complete listing of the claims under appeal is provided in an Appendix to this Brief.

IV. Status of Amendments

An amendment was filed on October 4, 2010 in response to the Final Office Action dated August 16, 2010. The Advisory Action dated October 14, 2010 indicates that the amendment was not entered.

V. Summary of Claimed Subject Matter

As required by 37 C.F.R. § 41.37(c)(1)(v), a concise explanation of the subject matter defined in the independent claims involved in the appeal is provided herein. Appellant notes that representative subject matter is identified for these claims; however, the abundance of supporting subject matter in the application prohibits identifying all textual and diagrammatic references to each claimed recitation. Appellant thus submits that other application subject matter, which supports the claims but is not specifically identified above, may be found elsewhere in the application. Appellant further notes that this summary does not provide an exhaustive or exclusive view of the present subject matter, and Appellant refers to the appended claims and their legal equivalents for a complete statement of the invention.

Commensurate with independent claim 1, an electric device (*see, e.g.*, page 3:1) is disclosed. The device includes a resistor with a layer of phase change material being changeable between a first phase with a first electrical resistivity and a second phase with a second electrical resistivity different from the first electrical resistivity (*see, e.g.*, page 4:25-27). The phase change material is a fast growth material (*see, e.g.*, page 3:25). The resistor is switchable between at least three different electrical resistance values by changing a corresponding portion of the layer of the phase change material from the first phase to the second phase (*see, e.g.*, page 4:29-31).

Commensurate with independent claim 17, an electric device (*see, e.g.*, page 3:1) is disclosed. The device includes a resistor with a layer of phase change material that is changeable between a first phase with a first electrical resistivity and a second phase with a second electrical resistivity different from the first electrical resistivity (*see, e.g.*, page 4:25-27). The phase change material is a fast growth material characterized by its crystal growth along an interface between an amorphous phase of the material and a crystalline phase of the material (*see, e.g.*, Fig. 1B and page 3:24-34). The resistor is switchable between at least three different electrical resistance values by changing a corresponding portion of the layer of phase change material from the first phase to the second phase (*see, e.g.*, page 4:29-31).

Commensurate with independent claim 19, an electric device is disclosed. The device includes a resistor with a layer of a phase change material that is changeable between a first phase with a first electrical resistivity and a second phase with a second electrical resistivity different from the first electrical resistivity (*see, e.g.*, page 4:25-27). The resistor is switchable between at least three different electrical resistance values by changing a corresponding portion of the layer of the phase change material from the first phase to the second phase (*see, e.g.*, page 4:29-31). The phase change material is a fast growth material (*see, e.g.*, page 3:25) and is a composition of one of: the formula $Sb_{1-c}M_c$, where $0.05 \leq c \leq 0.61$, and M is from the group of Ge, In, Ag, Ga, Te, Zn, and Sn (*see, e.g.*, page 19: 27-29); a material including Ge, Ga, or Ge and Ga (*See, e.g,* tables 1, 2 and 3); and a material that is substantially free of Te (*See, e.g.*, *Id.*).

VI. Grounds of Rejection to be Reviewed Upon Appeal

The grounds of rejection to be reviewed on appeal are as follows:

A. Claims 1- 6, 9, 13-15 and 17 stand rejected under U.S.C. § 102 over Czubatyj (U.S. Patent No. 5,825,046).

B. Claims 16 and 18-21 stand rejected under U.S.C. § 102(b) over Ovshinsky (U.S. Patent No. 5,912,839).

C. Claims 7-8 and 10-12 stand rejected under U.S.C. § 103(a) over the '046 reference.

VII. Argument

A. The § 102(B) Rejection of Claims 1-6, 9, 13-15 and 17 Over the '046 Reference is Improper For Lack of Correspondence.

The '046 reference fails to provide correspondence to a "fast growth material" as defined or characterized in the Specification. In asserting the teachings of the '046 reference, the Examiner failed to take into account that the requirement that an examiner must interpret the claims in a manner that is "consistent with the specification." M.P.E.P. § 2111 (*see* also M.P.E.P. § 2111.01 (an applicant can be his own lexicographer)). The specification explains what a "fast growth material" is and is not. For example, the specification explains that "fast growth material" is a class of materials that is distinguishable from known phase change materials based on a different crystal growth mechanism. In a more particular discussion, the specification explains that "fast growth material" transitions at relatively high approximate constant speed where crystallization proceeds along the interface between the two phases. *See* paragraphs 0011 and 0012 of the published application, and s*ee also* paragraph 0037. The Examiner has failed to establish that the material disclosed in the '046 reference corresponds to the claimed fast growth material. Further, the material of the '046 reference at best appears to align with the specification's discussion of previously-known phase change materials. For example, the '046 reference's teaching of a phase change material as being a modified form of a Te-Ge-Sb alloy, with an approximate combination of $Te_5Ge_2Sb_2$. *See* Col. 7:45-54 and Col. 8:40-44. Appellant discloses the prior art material, which uses nucleation in crystallization, as being an alloy with the approximate composition of $Sb_2Te_5Ge_2$. *See* paragraph 0003 of the published application. Appellant's specification specifically discloses such material changing through the nucleation process. *See* paragraph

0011 of the published application. Accordingly, the '046 reference appears to be merely cumulative prior art that does not disclose a fast growth material as claimed. Therefore, the '046 reference lacks correspondence to the claimed invention.

The Examiner's arguments in response to Appellant's previous arguments regarding the "fast growth material" are improper in several ways. First, the term "fast growth material" as used in the claims and specification, is a term to describe a specific type of material. The use of "fast" is not simply used as an adjective, but rather as part of a greater descriptive name given to a material having specific characteristics described within the specification. Second, contrary to the Examiner's assertions, requiring a look at the specification to determine the meaning of "fast growth material" does not read limitations from the specification into the claims. As previous brought to the attention of the Examiner, and reiterated above, "[d]uring patent examination, the pending claims must be 'given their broadest reasonable interpretation consistent with the specification.'" M.P.E.P. § 2111, *citing Phillips v. AWH Corp.*, 415 F.3d 1303, 1316 (Fed. Cir. 2005), that "[t]he broadest reasonable interpretation of the claims must also be consistent with the interpretation that those skilled in the art would reach." *Id.*, and that "[a]n applicant is entitled to be his or her own lexicographer and may rebut the presumption that claim terms are to be given their ordinary and customary meaning by clearly setting forth a definition of the term that is different from its ordinary and customary meaning(s)." M.P.E.P. § 2111.01. One of skill in the art would look to the specification to determine the meaning of "fast growth material." In doing so, one of skill in the art would realize that the material of the '046 reference is not "fast growth material" as defined by Appellant's specification, and accordingly that the '046 reference does not correspond to the claimed invention.

Further, as asserted previously, Appellant has acted as lexicographer and defined the meaning of "fast growth material." The specification uses the term "fast growth material" thirteen times throughout the specification. Each use of the term further defines the definition of "fast growth material" as having a different crystal growth mechanism than the previously defined class of phase change materials, and that the growth pattern is as described in Figure 1B. Therefore, the Examiner's continued insistence that the phase change material of the '046 reference corresponds to the claimed "fast growth material" is improper.

Accordingly, the § 102(b) rejection of claims is improper and Appellant requests the rejection be reversed.

B. The § 102(B) Rejections of Claims 4-6, 9, 13-15 and 17 are Further Improper For Lack of Correspondence.

The Examiner has failed to support his assertions that the '046 reference corresponds to the limitations of claims 4-6, 9, 13-15, and 17. On page two of the Office Action dated August 16, 2010, the Examiner asserts that claims 1-6, 9, 13,-15 and 17 are anticipated by the '046 reference, but then goes on to only asserts correspondence to claims 1-3. The remaining claims 4-6, 9, 13-15 and 17 are not mentioned. No portions of the '046 reference are cited as corresponding to the various limitations of those claims. Should the Examiner attempt to assert portions of the '046 reference as corresponding to the various limitations of these claims, such an assertion would constitute new grounds of rejection. *See Hyatt v. Dudas*, 551 F.3d 1307, 1312 (Fed. Cir. 2008) ("a 'ground of rejection' for purposes of Rule 1.192(c)(7) is not merely the statutory requirement for patentability that a claim fails to meet but also the precise reason why the claim fails that requirement."). As the record stands, the '046 reference has not been asserted to correspond to claims 4-6, 9, 13-15 and 17.

Further, the '046 reference does not appear to correspond to various aspects of the claims. For example, claim 13 requires that the phase change material be substantially free of Te. However, the asserted phase change material of the '046 reference, as discussed above, is an alloy with the approximate composition of $Sb_2Te_5Ge_2$. Such a composition is not substantially free of the element Te. Accordingly, the '046 reference lacks correspondence to at least claim 13.

Appellant requests that the § 102(b) rejection of claims 4-6, 9, 13-15 and 17 be reversed because the Examiner has failed to allege correspondence, and the '046 reference appears not to correspond to at least certain aspects of the claims.

C. The § 102(b) Rejection of Claims 16 and 18 Over the '839 Reference as Improper.

The Examiner has failed to properly assert correspondence to various aspects of the claims in the Office Action dated August 16, 2010. According to M.P.E.P. § 2131, "A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). Claims 16 and 18 depend from claims 1 and 17 respectfully, both of which the Examiner rejected over the '046 reference. The rejection of claims 16 and 18 fail to assert correspondence to the limitations of the claims from which they depend. As the Examiner has failed to show each and every element of the claims in a single reference, the rejection is improper.

Further, as the record stands, the rejection of claims 16 and 18 appear to be improperly presented as § 103(a) rejections, because the Examiner asserts a different reference for the underlying claims. However, the Examiner has not met the requirements for a § 103(a) rejection, including, for example, providing some articulated reason as to why the two references would be combined.

Accordingly, the § 102(b) rejection of claims 16 and 18 is improper and Appellant requests it be reversed.

D. The § 102(b) Rejection of Claims 19-21 Over the '839 Reference is Improper.

The Examiner has failed to properly assert correspondence to various aspects of the claims in the Office Action dated August 16, 2010. According to M.P.E.P. § 2131, "A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). The Examiner has failed to assert correspondence to various aspects of the claimed invention including, for example, the resistor being switchable between at least three different electrical resistance values, and the phase change material being a fast growth material.

Further, the '839 reference does not appear to teach certain aspects of the claimed invention. For example, the '839 reference does not appear to disclose a material having the growth mechanism associated with fast growth materials. For example, as shown in Fig. 1 of the '839 reference, the abrupt change in resistance is not constant with a material that is changing from an amorphous phase to a crystalline phase at an approximately constant speed.

Accordingly, the § 102(b) rejection of claims 19-21 is improper and Appellant request it be reversed.

E. <u>The § 103(a) Rejection of Claims 7-8 and 10-12 is Improper.</u>

The Examiner's § 103(a) rejection of claims 7-8 and 10-12, which depend from claim 1, lack correspondence for the reasons stated above in Section A. For example, the '046 reference does not teach a fast growth material. As the Examiner has not provided any reference that teaches a fast growth material, such a modification to the '046 reference is not obvious, and the § 103(a) rejection of dependent claims 7-8 and 10-12 is improper.

Further, the § 103(a) rejection of these claims evidences a misunderstanding of what is being claimed. In attempting to assert correspondence, the Examiner proposes that specific limitations of the claims are obvious because one of skill in the art would discover optimum working ranges. However, this position ignores the teachings of the '046 reference, and the specifics of the claim limitations. For example, claim 11 includes a limitation wherein the phase change material has a formula of $Sb_{1-c}M_c$. In attempting to assert correspondence, the Examiner erroneously alleges that such a formulation of the phase change material would be obvious and realized by routine experimentation. A careful reading of the M.P.E.P. and the cited decision, *In re Aller*, will clarify that in the absence of some suggestion to modify, a § 103(a) rejection cannot be maintained based on assertions that the invention is merely a design choice or a realization from experimenting with the prior art; if that were the standard, no patent would issue. The '046 reference lacks any information regarding materials (as claimed and disclosed in the specification) having minimum formulation of $Te_aGe_bSb_{100-(a+b)}$. Further, the '046 reference lacks any suggestion that experimentation (routine or otherwise) would be useful to pursue any aspect(s) or advantage(s) realized by a phase change material as disclosed and claimed by Appellant.

Accordingly, the § 103(a) rejection is improper and Appellant requests the rejection be reversed.

VIII. Conclusion

In view of the above, Appellant submits that the rejections of claims 1-21 are improper and therefore requests reversal of the rejections as applied to the appealed claims and allowance of the entire application.

Authority to charge the undersigned's deposit account was provided on the first page of this brief.

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APPENDIX OF CLAIMS INVOLVED IN THE APPEAL
(S/N 10/599,270)

1. An electric device having:

a resistor comprising a layer of a phase change material being changeable between a first phase with a first electrical resistivity and a second phase with a second electrical resistivity different from the first electrical resistivity, the phase change material being a fast growth material, the resistor being switchable between at least three different electrical resistance values by changing a corresponding portion of the layer of the phase change material from the first phase to the second phase.

2. An electric device as claimed in claim 1, further comprising means for switching the resistor between the at least three different electrical resistance values.

3. An electric device as claimed in claim 1, wherein the portion of the layer (7, 107) of phase change material is in direct contact with a further resistor (6, 106) arranged in parallel with the resistor.

4. An electric device as claimed in claim 3, wherein the further resistor has a further electrical resistance which is smaller than the largest of the at least three different electrical resistance values.

5. An electric device as claimed in claim 4, further comprising a read out signal generator for providing an electric read signal having a read voltage (V) to the resistor and a read out circuit for determining the resistance value from the electric read signal, the read out circuit requiring a minimum current (I), the further resistance (R_{fr}) being smaller than the read voltage (V) divided by the minimum current (I), (R_{fr}<V/I).

6. An electric device as claimed in claim 4, further comprising a read out signal generator for providing an electric read signal having a read current (I) to the resistor and a read out

circuit for determining the resistance value from the electric read signal, the read out circuit requiring a minimum voltage (V), the further resistance (R_{fr}) being smaller than the minimum voltage (V) divided by the read current (I), ($R_{fr}<V/I$).

7. An electric device as claimed in claim 4, wherein the resistor is switchable between N different electrical resistance values, N being an integer larger than two, the electric device further comprising a read out circuit for determining the resistance value, the read out circuit being able to discriminate between two resistance values having a relative resistance difference larger than or equal to a minimum detectable relative resistance difference $(dR/R)_{min}$, a ratio ($k=R_{fr}/R_{cr}$) of the further resistance (R_{fr}) over a minimum resistance (R_{cr}) of the layer (7, 107) of the phase change material satisfying $k/[(1+k)(N-1)]>(dR/R)_{min}$.

8. An electric device as claimed in claim 3, wherein the layer of phase change material and the further resistor have a contact resistance of 10^{-7} V cm^2/A or less, preferably 10^{-8} V cm^2/A or less, preferably 10^{-9} V cm^2/A or less.

9. An electric device as claimed in claim 1, wherein the phase change material constitutes a conductive path between a first contact area and a second contact area, a cross section of the conductive path being smaller than the first contact area and the second contact area.

10. An electric device as claimed in claim 5, wherein a part of the conductive path having the said cross section constitutes a volume of phase change material, the volume having an electrical resistance which is larger than an electrical contact resistance at the first contact area and/or at the second contact area, irrespective of whether the phase change material is in the first phase or the second phase.

11. An electric device as claimed in claim 1, wherein the phase change material is a composition of formula $Sb_{1-c}M_c$ with c satisfying $0.05 \leq c \leq 0.61$, and M being one or more elements selected from the group of Ge, In, Ag, Ga, Te, Zn and Sn.

12. An electric device as claimed in claim 11, wherein c satisfies $0.05 \leq c \leq 0.5$, and preferably $0.10 \leq c \leq 0.5$.

13. An electric device as claimed in claim 1, wherein the phase change material is substantially free of Te.

14. An electric device as claimed in claim 1, wherein the resistor is comprised in a body, the resistor constitutes a memory element, and the body further comprises:

an array of memory cells, each memory cell comprising a respective memory element and a respective selection device, and

a grid of selection lines,

each memory cell being individually accessible via the respective selection lines connected to the respective selection device.

15. An electric device as claimed in claim 14, wherein:

the selection device comprises a metal oxide semiconductor field effect transistor having a source region, a drain region and a gate region, and

the grid of selection lines comprises N first selection line, M second selection lines, and an output line,

the resistor of each memory element electrically connecting a first region selected from the source region and the drain region of the corresponding metal oxide semiconductor field effect transistor to the output line, a second region of the corresponding metal oxide semiconductor field effect transistor, selected from the source region and the drain region and lying free from the first region, being electrically connected to one of the N first selection lines, the gate region being electrically connected to one of the M second selection lines.

16. The electronic device of claim 1, wherein the fast growth material has a crystal growth mechanism wherein crystalline growth occurs along the interface between an amorphous phase of the material and a crystalline phase of the material, and the phase change material being a composition of the formula $Sb_{1-c}M_c$, where $0.05 \leq c \leq 0.61$, and M is from the group of Ge, In, Ag, Ga, Te, Zn, and Sn.

17. An electric device comprising:

a resistor comprising a layer of a phase change material being changeable between a first phase with a first electrical resistivity and a second phase with a second electrical resistivity different from the first electrical resistivity, the phase change material being a fast growth material characterized by its crystal growth along an interface between an amorphous phase of the material and a crystalline phase of the material, the resistor being switchable between at least three different electrical resistance values by changing a corresponding portion of the layer of the phase change material from the first phase to the second phase.

18. The electronic device of claim 17, wherein the phase change material is a composition of the formula $Sb_{1-c}M_c$, where $0.05 \leq c \leq 0.61$, and M is from the group of Ge, In, Ag, Ga, Te, Zn, and Sn.

19. An electric device comprising:

a resistor comprising a layer of a phase change material being changeable between a first phase with a first electrical resistivity and a second phase with a second electrical resistivity different from the first electrical resistivity, the resistor being switchable between at least three different electrical resistance values by changing a corresponding portion of the layer of the phase change material from the first phase to the second phase, and the phase change material being a fast growth material and a composition of one of: the formula $Sb_{1-c}M_c$, where $0.05 \leq c \leq 0.61$, and M is from the group of Ge, In, Ag, Ga, Te, Zn, and Sn; a material including Ge, Ga, or Ge and Ga; and a material that is substantially free of Te.

20. The electronic device of claim 19, wherein the fast growth material is a material including at least one of Ge and Ga at a concentration which in total is between 10 atomic percent and 30 atomic percent.

21. The electronic device of claim 19, wherein the fast growth material is a material including at least one of Ge and Ga at a concentration which in total more than 20 atomic percent, and including at least one of In and Sn at a concentration which in total is below 30 atomic percent.

APPENDIX OF EVIDENCE

Appellant is unaware of any evidence submitted in this application pursuant to 37 C.F.R. §§ 1.130, 1.131, and 1.132.

APPENDIX OF RELATED PROCEEDINGS

As stated in Section II above, Appellant is unaware of any related appeals, interferences or judicial proceedings.